

Adult play-learning

Adult play-learning: observing informal family education at a science museum

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Abstract

This paper discusses some of the issues surrounding the nature of adult play. More specifically, we explore ‘family play-learning’, where play activities result in forms of added knowledge or insight for the adults involved. Adult play itself is an under-researched area, and play-learning even more so. We discuss related research and, in particular, the roles that adults adopt when the family is learning together through play. We focus in particular on the processes involved as adults learn with, and from, their children. While family learning is widely discussed it, again in our view, lacks useful empirical evidence of its effectiveness. We use Bandura’s theories of social cognition to analyse participant observations of 97 families while they made and played with toys within the informal educational system of a major science museum. Our agenda has been to detail some of the processes of learning through Bandura’s four levels of observation, imitation, achievement and independence, and explore how these can be used to describe the ‘upward transmission’ of knowledge from children to adults.

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Introduction

In this study we discuss intergenerational family learning. Our overall purpose is to focus on the modelling and transmission of practices, attitudes and beliefs between generations, how family learning can be realised in practice. In particular, we shape this study to describe, from within the multiple transmissions possible between family members, ways in which adults learn from their children. The site of our research is the Thai Traditional Technology Gallery at the National Science Museum in Bangkok, Thailand. As one of the museum's six major galleries it houses an exhibition of traditional Thai toys and regularly hosts voluntary hands-on activities for visitors. In this instance, day-visiting family groups are invited to an activity space and supported in their own construction of, and play with, traditional toys. These make-and-play activities are designed not just to encourage technological skills but are also intended for participants to discuss the contemporary science behind the toys and share some of the rich cultural heritage attached to them. The museum has on average 1000 visitors a day and, second to school parties, families constitute the majority of groupings. The Traditional Thai Toy Activity (TTTA) space holds a maximum of some 40 participants and so around eight or ten families can be drawn in to the space at any one time to engage in the toy-making activities.

In this paper we explore the intersection of (i) adult play-learning, (ii) family learning as an aspect of intergenerational learning, and (iii) informal education within a science museum. We picture the adult learning involved as a subset of family play-learning, which is itself a subset of family learning, which is in turn a subset of intergenerational learning. We show this relational nesting in figure 1.

Figure 1 about here please

Numerous studies provide evidence of children learning from adults, in this study we draw in particular on Bandura's (2005) social cognitive theory, to illustrate instances in which the normal 'learning transmission' can be reversed, from child to adult. These are the ways – as Rogoff *et al.* (2001) put it – that, 'Adults learn from their own involvement as they foster children's learning' (p83).

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Bandura's (2005) general approach suggests social learning processes begin with a person observing, then modelling - emulating - the experiences of other people in close proximity, before moving to positions of achievement, confidence and then to self-reliance. Our data is drawn from 'messy' naturalistic observations of adults as their families participate in the noise and involvement, the 'buzz of activity' of the make-and-play tasks. Our research intention is to illuminate and illustrate adult play-learning *in situ*, as part of a wider study of informal science education (Author, 2013). Our analysis explores some of the process, and makes use of Bandura's levels to shape the complexity of rich data we have collected. We discuss in other reports (Authors, 2012, Authors, 2013) what it is the adults learn, the scientific and cultural knowledge they accrue, our interest here lies in process. Before considering our specific study, we first position this within discussions of adult play and play-learning, of family learning and informal museum education

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'We don't stop playing because we grow old; we grow old because we stop playing' – George Bernard Shaw, 1856-1950, Irish Playwright and Nobel Prize Winner

In their useful 2008 paper, Van Leeuwen & Westwood point out the enormous gap in the literature surrounding the nature of adult play, playfulness and learning through play. While in the last decade there have been some 3000 psychological research papers focussed on children's play, only some 40 have addressed play in adults. These authors also point out that the few papers over this time have been largely in the context of therapy rather than from any broader, more comprehensive, perspective. In this fuller vein, Carpenter & Aune, (1997) argue that play is a fascinating and pervasive activity that includes many behaviours that are perceived as enjoyable, humorous and entertaining. So, for example, in terms of functions, play can provide an index of intimacy, can be a moderator of conflict, a strategy for testing potentially embarrassing actions, a creative outlet, a way to communicate, and a way to promote relational intimacy (Baxter, 1992).

Some argue for a 'play instinct' that is simply part of being human, famously Huizinga's (1955) *homo ludens*, which is a human drive to play, for example, with words, images and actions. Others argue that play is a biological imperative to prepare

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children for the travails of adult existence, but this latter direction does little to explain why these characteristics persist into adult life. While for most species play primarily occurs early in life, it is the case that human evolutionary development incorporates *neoteny*, which involves the retention of juvenile physical characteristics in mature individuals, and the prolonged play impulse well into adulthood. This means that exploratory behaviours, driven by curiosity for the novel and pursuit of the effective, do not disappear with childhood or youth but persist, especially in the play-like endeavours of art and science. '[A]dult play,' Desmond Morris has said, 'is what gives us all our greatest achievements - art, literature, poetry, theatre, music and scientific research' (Morris, 1967, p17).

Play, though, is usually associated with children and theorists have struggled unsuccessfully for years to reach consensus on a definition of adult play (e.g., see Sutton-Smith, 1997; Hughes, 2006; Mainemelis & Ronson, 2006; Else, 2009). Regardless of all of the differences between adults and children, Kerr & Apter (1991) point out that adult play is a suitable and respectable way to describe intense and meaningful adult learning. Being 'playful' is a multidimensional construct encompassing cognitive, affective, and conative components, which together constitute a continuum along which individuals range from low to high (Glynn & Webster, 1992, p85). Else (2009) discusses an 'integrated play framework', as an exchange between conscious and unconscious thought, feelings and actions in play, its 'inner immersion' and 'outer displays', and the individual and social aspects of play. To this extent, play can be a highly emotional, internal and individual activity or be very physical, external and social, intended or unintended, with all shades in between. Else applies this framework to both children and adults and concludes (2009, p125) that play is almost impossible to fully define, not least because it is 'a mindset': it is the person involved who actually chooses whether an activity is 'playful' or not.

A number of studies have looked at adult play in the workplace (for example, Leibermann, 1977; Mainemelis & Ronson, 2006). In their study, Glynn & Webster's (1992, p97) separated adult play behaviours (both 'positive' and 'negative') into five groups: (i) *spontaneous* (impulsive, adventurous, free-spirited); (ii) *expressive* (bouncy, animated, excitable); (iii) *fun*: (bright, exciting, playful); (iv) *creative*: (active, imaginative, creative), and (v) *silly*: (childlike, whimsical, frivolous, unpredictable). The general sense here is that play need not be seen as some deviant and undesirable distraction from 'real' work, but an inevitable and often creative response to tasks at

hand.

There are studies, too, that discuss adult leisure, sporting activity, game-play strategies, computer and on-line gaming (reviewed, for example, by Crowe & Bradford, 2006; Authors, 2013c). Within this literature, we side with Cohen (2006) who maintains that current theory in adults' learning through play lags seriously behind the actuality of a steady increase in play activities in adult life. Rennie & McClafferty (1997), for example, discuss children's museum play, but not that of adults. Grenier (2010), too, makes the point that while games and play are acknowledged as important to adult learning, this area is largely absent from adult education discourse. Given the paucity of work in this area, our present study attempts a description of adult play-learning behaviour. Our observational data, collated below, have allowed us to describe some aspects of adult playfulness and play-learning through Bandura's levels.

Three dimensions of play

Playful approaches in education sit well within constructivist theories of learning. Constructivism is centred on the concept that individuals construct their own perspective of the world based on their interpretations of personal experiences (for example, Gagnon & Collay, 2006). Our work in this area (Authors, 2011) argues from a post-Piagetian perspective, that 'play-learning' is associated with curiosity, novelty, exploration and experimentation. It is a thesis that suggests inquisitiveness: discovery and play allow the individual (adult or child) to make new distinctions about novel elements in their environment (including new settings, objects and social situations). This revolves around the development of schemata that enable the play-learner to be purposeful, and involves information gathering, visualisation, investigation, testing, manipulation of situations, and result in the construction of his or her own knowledge. Adult learners then, whether in formal or informal educational settings, change their perspectives in response to additional experiences, new information, fresh ideas and reflection (Baxter Magolda, 1999; Biggs, 1999). We see this process as cyclical, a spiral over time, as ideas are revisited and reformed (Kolb & Fry, 1975). First-hand make-and-play experiences such as the ones we describe are seen to strengthen and/ or alter existing schemata and/ or create new ones. Participants in a play activity construct their own knowledge by testing ideas and concepts based on prior schema, applying these to new situations, risking innovations, and then attempting to piece together and integrate the new knowledge. Within the context of a museum, there is enormous appeal in

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experiential interactivity (Adams & Moussouri, 2002) where the interactive experience can actively engage the visitor physically, intellectually, emotionally, and socially in play-learning.

An earlier comprehensive review of literature on play by Rubin, Fein & Vandenburg (1983) led them to describe play by three dimensions, i.e., context, disposition (mindset) and behaviour and, with Else's notion of playful in mind, we follow this broad direction here:

(i) Context

Play is context-dependent. There are, in our view (Authors, 2012), both 'play-zones' and 'no-play-zones'. The first encompass those physical and virtual spaces where play is encouraged, where people have play 'in mind': sporting arenas; parkland; countryside woodlands and beaches; youth centres; arcades; theme parks; a comedy show; streets; gardens; bedrooms, game-worlds. A 'no-play zone' is where play is forbidden, deemed a distraction, inappropriate, uninvited, curtailed: a three-lane motorway, a church, a busy construction site, the company board-room, some lecture theatres, classrooms, at a funeral, and so on. It is clear, too, that even within these distinctions there are 'cross-overs': occasions where something humorous occurs that makes play possible, even where this contravenes conformity, conditions, expectations.

In a similar vein, a learning environment is a space where the resources, time, and reasons are available to a group of people to nurture, support, and value their learning of a limited set of information and ideas (Rieber, 2001). Learning environments are social places even when only one person can be found there. The centre of a learning environment is sharp, clear, and focused, but the edges are very fuzzy. There are limits to each learning environment, both in what can be learned there and whose learning will be supported most. It is most common to describe a learning environment by the types of resources to be found there, but while the resources are crucial to a learning environment's effectiveness, resources are only as good as the conditions under which one has access to them.

The work we describe in this paper brings together these two contexts: the expectations of learning within a play-zone. The context of play, and the disposition to play (as discussed below), creates an atmosphere where play-learning can take place. For example, Archer *et al.* (2009) describe how many of the young Chinese women in their study took on more 'playful' identities as learners once within an informal educational

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context. They note that this was in striking contrast to the common picture within mainstream education of Chinese femininity as passive, quiet and repressed 'educational automatons' (p489). That is, the context allows dispositions of playfulness to surface.

(ii) Disposition

Even when the zone is appropriate, where the people and the setting are right, play may still not take place. As Else (2009) maintains, play is personally directed, trades upon a disposition, a mood, and is commonly autotelic - undertaken for its own rewards. While it certainly has a social dimension, evident in the examples we give later, it is the individual who has the veto on play – a group cannot force an individual to 'play' against his or her will. Play is voluntary. If the requirement to play is increased, or if external demand or pressure is intensified, if the 'pleasure principle' diminishes, then play will cease – it becomes something else. Play must involve pleasure: where there is no pleasure, no fun, no enjoyment, then there is no play. When play becomes a requirement, a chore, becomes tedious, is imposed or required, then it ceases to be play. A number of researchers have generated evidence to argue that playfulness is an observable and measurable disposition (for example, Harris, 1989; Barnett, 1991; Rogers *et al.*, 1998). Barnett (2006) defines playfulness as follows:

Playfulness is the predisposition to frame (or reframe) a situation in such a way as to provide oneself (and possible others) with amusement, humour, and/or entertainment. Individuals who have such a heightened predisposition are typically funny, humorous, spontaneous, unpredictable, impulsive, active, energetic, adventurous, sociable, outgoing, cheerful, and happy, and are likely to manifest playful behaviour by joking, teasing, clowning, and acting silly (p955).

Playfulness encourages people to be imaginative, inventive, smart, creative, happy, flexible, problem-solving and resilient (Mainemelis & Ronson, 2006; Kemp *et al.*, 2011); play can also be a supportive tool to help adults to create new ideas (Patterson, 2011). From our perspective, when people exhibit playfulness, they can be prompted into learning.

It is certainly true that most participants in our study arrived with a positive dispositional mindset towards play. In general, Thai people lead peaceful lives, Thailand pictures itself as the 'land of smiles' (Thailand Tourist Authority, 2011),

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where people are happy and funny. They see themselves as calm and seldom impulsive, spontaneous or unpredictable, ways that might characterise people in other countries. These visitors had arrived at the museum as a 'day out', intending an enjoyably, convivial and informative day with friends and family. In addition, by taking up the invitation to make-and-play the traditional toys, they were further signalling their intentions to enjoy themselves. It is perhaps unsurprising, then, that the great majority were predisposed to play and enjoy the activities.

(iii) action

There are numerous anecdotes of the child who ignores the expensive birthday present but plays happily with the large box it came in. Play, in this sense, is experiential, anything can become the object or the topic of play. While some objects invite play, it is not the object itself, but what is done with it that marks out play. In our work we discuss numerous different objects of play but are interested primarily in the activities surrounding these rather than the objects themselves. That is, the traditional Thai toys are used to stimulate learning, knowledge, imagination, construction, and encourage awareness of values (Frobose, 2008; Kanhadilok, 2011).

In many parts of the world, people play through celebrating festivals, carnivals, events. In Thailand, for example, 'kite-fighting' celebrates the first winds of the season, with their importance for transportation. Amateur kite-makers from each part of Thailand present their unique designs and compete either in terms of their creativity, or their fighting capacities. The traditional Thai 'Loy Krathong' festival raises awareness of the value of rivers and water. During Loy Krathong people offer up thanks to '*Ma Kongka*' (the mother of rivers) who provides water to the land every year, for daily life, agriculture and transportation. Teams compete to make and race 'krathong', rafts about a hand-span in diameter made traditionally from a section of banana tree trunk, specially made bread 'flowers' decorated with elaborately-folded banana leaves, flowers, candles, incense sticks (Satayasai School, 2007).

Family learning

Family Learning provokes wide-ranging discussion. It has been described as: parents and children learning together; parents learning more about how their children learn; parents taking up learning opportunities to benefit their own learning, including literacy and numeracy, parenting courses, or other courses which interest them; learning with

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siblings, grandparents, step family and close family friends, and – in some instances – adults learning from their children (Authors, 2001),

‘Families are the main context of learning for most people. Learning within the family is usually more lasting and influential than any other. Family life provides a foundation and context for all learning’ (NIACE, 1995, p132).

The UK’s Learning and Skills Council (2007) suggests that family learning includes a wide range of formal and informal provision for family members to learn literacy, numeracy, citizenship, health, parenting and many other subjects. The Office for Standards in Education, Children’s Services and Skills (Ofsted, 2009) surveyed a range of provision in terms of the family learning being offered in the UK. Between September 2008 and March 2009, inspectors visited 23 local authority adult and community learning services and generally approved what it saw, as making a considerable impact on children and adults. Where good family learning took place, children were reported to have improved communication, confidence, interpersonal skills, and to have improved relationships with classmates and teachers. Ofsted inspectors found family learning to make a big impact on parents too, leading to employment and qualifications for people from often deprived communities. Parents saw family learning make a real difference to their lives, expanding their social networks, improving their employment prospects, increasing their involvement in school life, and giving them the confidence and skills to help their child.

Where more specific research evidence exists it tends to focus on particular family dyads and specific areas: mothers working with their children’s reading; fathers and boys’ physical skills, grandparent and grandchildren baking cakes. Franz (2009) makes a similar point in her review of empirical research, that while there are a number of instances of particular good ‘learning interactions’, learning between the generations most commonly ‘just happens incidentally while the generations are cooking and playing together’. That said, it is also clear that the family provides a powerful foundation for literacy experiences for children (Pahl & Rowsell, 2012). In almost all of these studies, the emphasis remains on the ways in which children learn from adults, not vice versa, and we see our own empirical research as providing some small support for instances of this inversion.

Cooper (1997) has pointed out that families visit museums to seek pleasure and enjoyment from their visit, and Kolb & Kolb (2010) suggest that museums are actually

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designed as ludic (playful) learning spaces. In this context, we see family learning occurring when parents and adults in the family group encourage children's learning through asking and answering the questions, talking about the exhibits, pointing to various section, reading text, and when family members participate fully, engaging in hands-on activities (Grenier, 2010). Adult learning, then, takes place in parallel with teaching or introducing knowledge to their children (Hilke, 1987). Borun, Chambers & Cleghorn (1996) have stated:

A family group that visits a museum can enrich its culture, storing knowledge for later sharing among family members. We can think of this as 'potential learning' by analogy to potential energy. If information and associations are acquired by a member of the group, they are available for exchange with other family members, not just at the moment of acquisition, but at any time in the future (p125).

The families in this study are multi-generational groups, with one or more adults accompanying either a single child or several children and young people to visit the museum. As noted earlier, we have chosen to examine their interactions from the perspective of Bandura (1986, 2001) social learning theories. In Bandura (2005) he contends that 'vicarious learning' through familial role-modelling involves learning through observing the actions of others in the family, and its effectiveness depends upon how well such people are able to support the learning taking place. Support from 'trusted others' is important, not least because they are able to share concerns about their own lack of confidence and how common it is to have difficulties in certain areas. In our case, the learner is copying, or emulating others and then developing to a level of self-control, self-maintenance (Zimmerman & Schunk, 2001). Bandura (2005) suggests four levels:

Level 1: an observational level during which learners watch a role model performing the skill to be acquired. Within the context of our own study, this may be a parent or older sibling watching a younger child initiate a task, conceptual or constructional. The child is commonly the centre of attention as the others watch the task unfold

Level 2: the other members of the family then begin tasks of their own, guided by the better, more accomplished, more experienced members of the group. In our case, the older members of the family now begin to take up the task themselves, they try - with assistance - to adopt the model behaviour, and move to the 'emulation level'. In

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making a working toy themselves, they become supported by the help of the initiator, often newly-experienced nimble fingers guiding older ones.

Level 3: the ‘learner’ members of the family gain achievement in their tasks supported by, but largely independent of, their family role models. At this third level - the level of self-control - the learners practice the behaviours independently of the younger role model, but still in the supportive, structured environment. The older learner undertakes the task themselves while children and guides look - on at the same time as they continue their own tasks

Indications of Level 4: the learners will take learning derived from the activity and repeat, adapt and improve on it elsewhere. In our case, we are unable to witness Bandura’s fourth level, this self-regulated level, simply because these adults take their learning out of the immediate setting and replicate it, for instance, at home and essentially outside our purview.

In these make-and-play activities, the conditions for family learning are good (very attentive, close social collaboration, high levels of interest and meaningful activity). So, these tasks create opportunities for direct and reciprocal learning, within a very sociable, low-didactic group setting. Various levels of skill and understanding are simultaneously and transparently on open display, and - in an atmosphere of mutual trust – family members provide positive feedback and guidance to parents and siblings.

The National Science Museum, Thailand

The National Science Museum in Thailand was opened to the public in 2000 and has a dual mission: to develop both Western scientific literacy and the traditional local cultural wisdom of Thai society. Its purpose is to foster awareness in its visitors of the importance of science and technology in everyday life, and in the sustainable development of the country through community understanding (The National Science Museum, Thailand, 2004). In general, science museums are sites of informal education for visitors all of ages, designed to help visitors understand more about contemporary science (Goolnik & Curtis, 1995). Thailand’s Science Museum aims to be the country’s national centre for informal science education, the Thai Traditional Technology gallery is designed specifically to inspire learning about the relationship between scientific knowledge and local Thai wisdom (The National Science Museum, Thailand, 2007).

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The toy collection showcases old toys made from natural materials, that have appealing designs, fascinating movement and, these days, are relatively rare to find. The toys, such as toy insects, are commonly constructed from local natural or waste materials, and the examples we discuss here are made through wickerwork.

Wickerwork products are used in every functional aspect of daily life in Thailand. House roofing, walls, furniture, baskets, hats, mats can all be made from natural fibre and, in many instances, created into objects of considerable beauty. The attraction of wickerwork is its simplicity, elegance and durability, using the strength and resilience of, for example, cut and dried bamboo and rattan, that are woven into forms that are light, strong, and attractive. Several other kinds of indigenous plants, such as sedge and bulrush can be used - the most famous wickerwork is the basketry made of a southern fern-vine called *yan lipao*.

As Kolb & Kolb (2010) suggest, the TTTA is an example of a carefully designed ‘play-zone’ within the science museum and the traditional toys are the props of play. They are the objects or equipment with which individuals - children and adults - play for both enjoyment and knowledge, cognitive and imaginative (Goolnik & Curtis, 1995).

The study

The work we report in this paper is part of a tranche of work with the museum (Author, 2013). It covers a specific study at the museum’s Traditional Thai Gallery, focussed upon five typical days when arriving visitors were invited to activity sessions, periods of two hours making and playing with traditional toys. The activity space can cater for a maximum of 40 people at any one time, the research follows 92 mixed-age families, a total of 179 participants, over the five days spread across June, a busy month for the museum. One of us (PK) worked closely with a team of Explainers, the museum staff employed within the Traditional Thai Technology gallery and the TTTA itself and who, for this study, acted as research assistants. First, the families were invited to explore the toys exhibition and play with the collections of toys already there. Then participants were invited into the wickerwork toy-making activity, led by the Explainers. The activity began with an introduction to traditional wickerwork technology and demonstrated the methods used to make three different wickerwork toys from which participants were able to choose. Throughout, there were task sheets, written guides and diagrams, help was provided on request and, most usually, participants gained information and ideas from the museum’s Explainers.

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The Explainers' were inducted into the research and their brief was clear, while being available to help and support the construction work, they also undertook structured observations of the family groups using an observation schedule (see appendix 1), noting obvious and manifest behaviours, for example, which of the toys engaged the participants most, which elicited most fascination and curiosity, how the visitors reacted.

Figure 2, in appendix 1 at the end of the article please

The Explainers paid close attention to the families throughout the session, made notes of people's comments and remarks, took photographs (with permission), and supported the observations and theory-building during the analysis of the data. As Gillespie & Michelson (2011) note, participant observation is serious, disciplined research. Participant observers work to gather a strong collection of stories that can be used to illustrate research themes and help draw connections between observations and points of theory. Immersive real-world research of this kind inevitably challenges the notion of objectivity and neutrality. In our case, all of the participants in each of the sessions agreed to be observed and were enormously cooperative in discussing their play and learning.

The initial analysis of the mass of data took place at the end of each session, first by the researchers and then in discussion with the Explainers. The observations, written notes and the photographs were supplemented, sorted and sifted, and allowed some examination of how grandparents, parents, adolescent sisters and brothers and younger children all communicated – not just verbally but through gaze, touch and action as well. Our key interest lay in the 'upward transmission' from child to adult, for example as children showed parents and grandparents how to make the toy work or teenagers talked about the physics of movement. Other 'directions of learning' were also noted, for example when grandparents reminisced about their early lives, childhood toys, recounted aspects of traditional culture to the children.

There is formidable complexity in observing individual and group actions and processes in learning and, while alternative theorising is an essential part of the research process, in this case we have imposed a form of linearity on the data through the four levels: observation, imitation, achievement, and self-reliance. Marshall & Rossman (1989: 21) once observed that, 'Quite unlike its pristine and logical presentation in journal articles, real research is often confusing, messy, intensely frustrating, and fundamentally

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nonlinear.’ Reducing our research output to a few key themes and levels inevitably wrought some violence to the rich diversity of these family interactions. Statistical procedures can be applied but not without enormous assumptions, so we settled for making sense of these five make-and-play day sessions in purely qualitative terms - in particular answering the question: In what ways do adults learn from children?

Behaviours: observing and recording family learning

Intergenerational activities like these comprise numerous examples of reciprocal learning. In all the interactions we observed between children and adults, knowledge and skills were shared sensitively in an atmosphere of warmth and trust. At times, when they were unsure what to do, they all asked questions of each other whilst simultaneously engaging the other’s gaze. In this section we report the observations under the four subtitles above.

(i) Observed Level 1 actions: members of the family group initiate a play-task and act as role models while being observed

Most participants, children and adults, engaged readily with the making of the wickerwork toys in the TTTA. Family groups commonly began by listening to the Explainers, reading the illustrated texts made available, examining the construction materials, exploring until they understood roughly how each toy was made, how the activity worked. In general, the younger children began the construction task unprompted and became quickly engaged, the key motivation being the challenge of the construction. While reacting in a free-spirited, spontaneous way they were also counselled to be careful and disciplined and, within a short time, had accrued first experience of working with the materials of the activity, more than the older, on-looker, members of the family.

Some of the activities proved quite difficult for the younger children, and it was clear that parents and adults sought to learn quickly so that they then were able to help the children. They checked the instructions, tested the materials and, in many instances, young adults, older siblings and parents took over part of the tasks while younger and older members of the family became the onlookers to watch these problem solving activities. One child said, “*When dad helps me, it is easy to make the toys.*” Adults commonly watched and guided with interest, some liked the wicker toys such as, for example, the wicker grasshopper. In this way, they lined up their interest, preparing to

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have a go: *“I like the Grasshopper toy, it looks like the real one. I will put it on the tree, I think, somebody would believe that it is a real insect [laughs]”*.

(ii) Observed Level 2 actions: other members of the family then begin to take up play-tasks of their own, guided by the accomplishments of the child

In general, though, Level 1 was a prelude to handing the half-made toy back to the child and beginning the construction of their own toy, as if to show how they could undertake the task better and to their own design. The adults chose their construction materials, the paints and colours they wanted, took their own task guides and resources, and began the process of assembling and making the wickerwork insects for themselves. They became purposeful, diligent and, even while it was obvious fun, they were earnest in their approach to the construction. Some of the older adults needed support in forming the insects, not least because of limited physical skills, hand-eye coordination when confronted by intricate designs. Younger family members, or the museum’s Explainers, demonstrated the skills involved and gave them constructive assistance. The level of ‘didacticism’ was generally low: the Explainers only intervened when asked, most other family members acted in a similar way, only providing support when help was sought. Young participants seldom hesitated in asking the Explainers how to solve construction problems, to offer help to other people, often to other families and gallery visitors in the room, with similar problem, or to tell others about construction problems before they got started. So, even though overt ‘didactic transmission’ was low, supportive and help-orientated, this did not prevent some young people, boys usually, from becoming ‘instructional’, and beginning to teach-and-tell directly. There was a sense that they needed to explain to parents and others how the activity worked to reinforce their own achievements.

(iii) Observed Level 3 actions: Where the ‘learner’ members of the family gain achievement in their tasks supported by, but largely independent of, their family role models

At this point, all members of the groups were acting in parallel, together yet independently. The children were able to complete their constructions, under guidance, but largely without direct helpful intervention. The adults tried to remember and follow the steps until they understand all of the making process for themselves. As one older adult said, *“I do actually remember how to make this toy, it is easier when you start at*

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the bottom.” Our study found that some tried to remember the toy making process through remaking again and again, some adults tried to review the toy process with their children and remember, some participants helped other people to make sure of their understanding. Their work became expressive and, even when self-controlled and busy, they appeared animated and excited. One grandparent engaged in ‘reciprocal teaching’ with her granddaughter, and said: “ *If you don’t teach [the toy making process] to me again, I won’t remember and I don’t think I can make it.*”

The participants showed considerable enthusiasm in following the activities led by their younger family members, by the museum’s Explainers, completing the activities in making the toys themselves, decorating them. When they finished, for example, the wickerwork insects, they enjoyed colouring the materials imaginatively, drawing further pictures of birds, flowers. The adults exhibited most playfulness when they demonstrated their toys to friends and family. Some family members tested and played with the toys by themselves, then invited friends and family over to join them and talk about the toys: when they found them worthy of note, they would call over and involve others in play, talk animatedly about the toys, how it worked: “*It’s funny*”, “*I like these toys*”, “*I want to buy it*” and “*Where can I get one?*” They took pride in their achievements, and met new people, other previously unknown participants at the gallery. Some children said that they had “*never made a toy before, this is the first toy in my life and I want to play with it with my family*”. Some adult participants reminisced: “*I remember, I used to play with toys like this with my parents. I’m going to take this toy home to my other children.*” Their behaviour showed repetition of the movements and sounds, clear facial enjoyment, often playing with some of the toys for extended periods until the allotted time was up. Some progressed to the next toys with equal enjoyment, for as long as the time allowed.

(iv) Surmised Level 4 actions: that the learners will try to take what they have learned from the setting and repeat, adapt and improve on what they have been doing.

We have no direct examples of this group of play-learning behaviours because, by definition, our participants would display these skills and competencies once away from the museum. Almost all adults showed keen interest in the wickerwork toys and said clearly that they wanted to make them again, by themselves. As one said, he would make another because “*I will give this toy to my sister*”. Another child said “*I can make*

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the fish wickerwork toy, I think, I remember the process of it and I will transfer this process to my friends in the school." During our observations, we did find that adults were interested in the activity because, in part, they wanted to revisit childhood memories when they enjoyed making toys like these before, and because they wanted to learn again in order to teach these skills to their children at home. Adults described how they want their children to learn from these activities to develop creativity and learning skills.

Although parents and grandparents possessed greater world knowledge in many areas, there were times when they recognised their dependence on the nimble-fingered skill and adroitness of the young. It was an acknowledgement of their own physical vulnerability and emphasised the knowledge and understanding possessed by the young.

Some caveats and summary discussion

Not all of the play-learning activities were entirely positive, or could even be designated as playful, and we need to note some of the moments of dissent that occurred. For example, a few signalled boredom with the activity, showed relatively low levels of interest. A number of these were men, visiting the Science Museum with their family, who seemed reserved, retained a forbidding sense of dignity and were unwilling to participate in the TTTA with their children. Some said, *'It is a child's activity'*, *'I have made toys like these before'*, and *'It's a waste of time.'* As for the children, there were some small examples of frustration. Some soon-bored children showed negative feelings when they could not follow steps in the toy-making process, such as binding the string or bending the bamboo sticks. They wanted to make the toys by themselves, could not manage alone, yet brooked little adult intervention. In moments of moodiness some young children said, *'I can't do it, it is too difficult for me.'* As we noted earlier, when play becomes tedious, when players become frustrated or disillusioned, when the fun ends, it then ceases to be play. We are aware, too, of the disadvantages and pressures sometimes faced by participant observers: making observations for research purposes can be a notoriously difficult process.

On the whole, though, the data are positive and compelling. There were three broad issues to emerge: first, such multi-experience family groups did enable reciprocal intergenerational knowledge exchange to take place. While the flow of information, suggestions, ideas, the knowledge development, was dynamic and fast-moving, this was beyond the simple transfer of knowledge from the expert to the less experienced: over

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the five sessions we charted consistent behaviours in adult-from-child learning. Second, the activities were open and inclusive, they were demanding and yet fun, conducted within a conducive social context that tolerated criticism and debate and helped individuals to solve problems collaboratively irrespective of their formal place in the family hierarchy. Third, we have been keen to add to research on aspects of adult play-learning where (i) the context is appropriate, (ii) the participants' disposition has been playful, and (iii) their actions and activities showed their engagement with, and fostering of, play.

In this way, we have provided some fine grain observations to the levels of role-modelling described by Bandura's (2005) social-cognitive theory, illustrating ways in which adults learn in their own right and, in many instances, learn from children. It is family play-learning of a particular kind, making traditional wickerwork toy insects within the context of a science museum's activities, but this enables us to explore the transfer of understanding and skills from the (young) role modeller to the (older) 'modellee'. We saw this learning to take place through several sub-processes:

- (i) *Being observed*: as, often, a young member of the family initiates the activity, with (older) members of the family watching, discussing and coaching
- (ii) *Take-up*: as, gradually, the structure of the activity would morph through the other family members beginning their own constructions. The adults and older members of the group would already know what to do, how to work better, simply from watching
- (iii) *Needing to explain*: as the first, younger, person commonly took the role of teacher because his or her construction was already more advanced
- (iv) *Being challenged*: as families, being kin with emotional bonds, with all of the cooperation and rivalry that entails – undertook the challenges of the toy-making. It was common that child–parent and sibling–sibling exchanges and banter took place. In most cases this was received as challenging-yet-positive feedback and support
- (v) *Gaining a fresh perspective*: as it became clear that, when beginning their own constructions, adults gained fresh ideas and resources from watching and guiding the child's activity in progress
- (vi) *Encouraged to Take Risks*: as the children modelled openness and flexibility. There was fun and pleasure in the activity, it was play after all, which

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reduced possible tensions in their relationships. Some adults took up the challenge to make bigger, more expansive, or more intricate and delicate toys

- (vii) *Reconstruction of tacit knowledge*: In many cases, the activity with the younger children seemed to act as a catalyst to unlocking and making available knowledge that might otherwise have remained largely 'forgotten' or hidden. In this sense, the children triggered reminiscences by parents and grandparents. Working with the toys gave them chance to relive past experiences, then relate moments of biography and share family history back to the others in the group.

This final point is interesting. Although many adults, particularly the older ones, had been exposed to such toys in the past, it was not until they actually experienced these activities, being in concrete situations with their families dealing with the tasks at hand, that their learning changed. Young children seemed to tap some of the tacit, dormant knowledge possessed by the adults, appeared to prompt their elders to recover what might otherwise have remained largely 'forgotten', and thereby, hidden. Playing with children allows adults to reminisce on their own childhood, while children gain learning experiences from interaction with positive role models as they share a special time together. As Davis, Larkin & Graves (2002, p44) say,

Intergenerational play creates a context for social interaction and learning for both younger and older generations. Time and patience, often in short supply in a family's daily routines, are not issues for the child and older adult in an intergenerational programme setting.

We offer this study as indicative rather than conclusive, and there is clearly much more research to be undertaken. Naturalistic studies of families in action are complex, their interactions can be rapid and multifaceted, occurring only sometimes in verbal form. Moments of learning are seldom visible in action, and the transference of knowledge and skills through communication between different generations of a family can occur in numerous directions within the same moment. This study has attempted to examine just one of these learning directions, and illustrate how the transmission from child to adult can occur. As Pinto (2010) has said, 'Intergenerational learning is the oldest method of learning.'

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Play is not only for children, but it also important for adults. Play has been reported to make adults feel alive, be important for their physical and mental health, their general wellbeing (Kemp, Smith, Dekover & Segal, 2011). Part of our thrust has been to point to the lack of research in both adult play and in family learning. Both can be seen as important phenomena in their own right, but this simply serves to highlight the added importance of research in this combined area, of adults learning through play, what we have come to call 'family play-learning'. Our three summary outcomes from this work show that, where the context is suitable and convivial, when adults are well disposed to play, and when their actions can be seen to be appropriate, then adults will explore, investigate, manage situations and test out new experiences, information, develop novel ideas, construct, be artistic and creative. In short, they will learn through play.

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